



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|------------------------|-------------|----------------------|---------------------|------------------|
| 10/597,000 | 06/12/2008 | Deyang Hou | | 4587 |
| 45462 | 7590 | 11/22/2010 | EXAMINER | |
| QUANTLOGIC CORPORATION | | | JONAITIS, JUSTIN M | |
| 5111 AVONDALE DRIVE | | | ART UNIT | PAPER NUMBER |
| SUGARLAND, TX 77479 | | | 3752 | |
| | | | MAIL DATE | DELIVERY MODE |
| | | | 11/22/2010 | PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|------------------------|---------------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 10/597,000 | HOU, DEYANG | |
| | Examiner | Art Unit | |
| | JUSTIN JONAITIS | 3752 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 24 September 2010.
- 2a) This action is **FINAL**. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-23 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 17 June 2010 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ . |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ . | 6) <input type="checkbox"/> Other: _____ . |

DETAILED ACTION

Drawings

1. The drawings were received on 6/17/2010. These drawings are acceptable.

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the conical surface being a diverging curved surface of claim 5, the conical surface with 2 conical surfaces of claim 4, plurality of multijet-orifices being on the conical surface of claim 7 as well as the various orifice types (semi-circular, arcs, triangles, trapezoids, etc), the variable circular aperture of claim 15, diagrams of flow during low to medium pressure and diagrams of flow during high pressure of claim 15, and the system with fluid as the driving means of claim 20, and the solenoid or piezo actuator of claim 22 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Claim Objections

3. Claims 11-13 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim 3-6. See MPEP § 608.01(n). Accordingly, the claims 11-13 have not been further treated on the merits.

4. Claim 19 is objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim s 3-6, 11-13, 17-18. See MPEP § 608.01(n). Accordingly, the claim 19 has not been further treated on the merits.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

Art Unit: 3752

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claim 1, 2, & 17 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply

with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Specifically, it's unclear what the device is doing in any of the states of fuel injection. The claim states that the minimum cross-section is at the sealing surface during the early stage (examiner assumes this means it's sealed), then at the middle stage of fuel injection the minimum cross-section (of the nozzle body) is at the micro-variable-circular-orifice or at the sealing surface.

First, it's unclear what applicant is referring to as the minimum cross-section, examiner assumes applicant means the minimum cross section of channel formed within the nozzle body which the head of the needle is formed. Second, the minimum cross section is the point where the micro-variable-circular-orifice is formed in the injector, so it's unclear how its position would change from the first stage of fuel injection to the second stage, further "the minimum cross-section is at the said micro-variable-circular orifice" can be neglected based on the "or" statement and read, "the minimum cross-section is at the sealing surface during the middle stage of fuel injection," which would mean that the needle has not moved from the first to second stage. Finally the claim states, "whereby it has means of ensuring fine atomization during all fuel injection stages." It's not clear what the means for ensuring fine atomization is referring to and appears that no fuel has been injected on any "stage" since the needle has not moved. Because of such, claim 17 has not been given patentable weight.

Claim 17 then continues to state "the minimum cross-section is at the sealing surface again during the late stage of fuel injection," which again indicates that the needle has not

Art Unit: 3752

moved as its changed states. Finally the claim states, "whereby it has means of ensuring fine atomization during all fuel injection stages." It's not clear what the means for ensuring fine atomization is referring to and appears that no fuel has been injected on any "stage" since the needle has not moved. Because of such, claim 17 has not been further examined on it's merits.

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 1-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically it's unclear what applicant intends to be claiming as the conical surface. Figure 2 discloses a location of Conical Surface (C) on the diagram, however the claims seem to contradict its location.

Specifically claim 7 states that the plurality of multijet orifices are ON the conical surface, whereas claim 14 states that the plurality of multijet-orifices "underneath the conical surface." Should such be taken into consideration than the conical surface disclosed by figure 2 cannot be the conical surface claimed as the multijet-orifices would not be located on the fuel injector. However based on this particular claim examiner will assume the conical surface disclosed by applicant is the conical surface in which the needle sealing surface contacts as it fulfills the claimed limitations of claims 3-4.

Claim 1 recites the limitation "its seal surface" in the claim. There is insufficient antecedent basis for this limitation in the claim.

Claims 8, 15 and 16 state that the fuel is injected through the variable circular aperture between the needle head and the conical surface of the nozzle body, bringing the claims back in line with the element (c) of figure 2.

For examination purposes, examiner chooses the interpretation of the conical angles being the surface in which the valve needle sealing surface contacts as it fulfills the claim requirements of claims 3 and 4. The limitations of the location of the conical surface of claims 7, 15 and 16 will not be given patentable weight, however the remainder of the claim will still be examined on its merits.

Further independent claim 1 claims a needle valve in section (i) of the claim and then claims a needle valve in section (ii) of the claim. Examiner assumes there is only one needle valve.

9. Claim 5 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically it's unclear how a conical surface can be a diverging curved surface and still be considered a cone.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claims 1-4, 5, 8, 14-16, 18, and 21-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Japanese Patent #JP10-299613 to Date.

Date discloses a Mixed Mode fuel injector comprising a nozzle body (nozzle body (5)) comprising a passage for fuel (long hole (19)) which is an inner cylindrical space for receiving a

Art Unit: 3752

needle valve (needle (6)), and a conical surface (Cone wall surface (27)) close to the tip of the nozzle body for guiding a spray of fluid. The needle valve having a converging-diverging conical head (converges at cone part (36) and diverges at umbrella part (38)) for guiding a spray of fuel. The needle valve being movable back and forth and received in the nozzle body, wherein when the needle valve is in a biased closed position with its seal surface (cone part (32)) being pressed against the nozzle body to block fuel flow. The device including a micro-variable-circular-orifice comprising a variable annular ring aperture (breakthrough (30) is in ring form in relation to the nozzle body and the valve needle) between the needle valve and the nozzle body to produce a hollow conical spray and a plurality of multi-jet orifices (nozzle holes (29)) underneath the conical surface forming a valve-covered orifice multi hole type injector, through blocking the annular aperture by the needle head at a predefined needle-lift range, the multi-jet orifices being inside the nozzle body which produces a jet spray such that fuel is dischargeable in variable sprays of hollow conical and multiple jet shapes by lifting the needle valve at different magnitudes.

Date further includes the conical surface being a single conical surface and including downstream (at the bottom of chamber (28)) a diverging curved surface (diverges in an upstream direction). Date also includes a second integrated conical surface (See Figure 3 at the top of nozzle body (5)) that is connected to the first surface. The conical surface's center line (which is the nozzle body's center line) and the centerline of the body being 0 degrees.

Date further discloses the needle head remaining at least partially received within the tip of the fuel injector when the needle valve is moved back and forth between the opened and closed position such that fuel is injected through the micro variable aperture between the needle head and the nozzle body fuel is also injected through the multijet-orifices. This particular setup allowing different shapes of fuel sprays being generated by the magnitude of the lift of the

needle valve so that at a low to medium injection loads, fuel is mainly injected through the variable circular aperture (small needle lift) and form a conical shape of spray, while at high injection loads, fuel is injected through both the variable circular aperture and the multi-jet orifices (larger needle lift) and thus forms a mixed mode conical multi-jet shape spray to provide different atomization desired by engine combustion at different loads.

The device by Date being driven by a piezo actuator (See Figure 2).

12. Claim 23 is rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent #3,042,317 to Simmons.

Simmons discloses a mixed mode fuel injector (two modes, on and off) which has a micro-variable-circular-orifice comprising a variable annular aperture (the space between valve body (5) and valve head (32) that is between a needle valve (formed from valve head (32) and neck (34)) and the nozzle body (nozzle body (5)) which is a means of producing a hollow conical spray, wherein the MVCO is used as a sole orifice.

Claim Rejections - 35 USC § 103

13. Claims 6, 7, 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent #JP10-299613 to Date.

In re claim 7, Date discloses the invention as described above but fails to disclose the plurality of micro channels on the conical surface with cross sections that are semi-circles, arcs, triangles, trapezoids, or other polygons.

It would have been obvious to one having ordinary skill in the art at the time the invention was made that the shape of the claimed channels would have been an obvious matter of design

choice. Please note that in the instant application applicant has not disclosed any criticality for the claimed limitation.

In re claims 6, 9-10, Date discloses the invention as described above but fails to disclose specific dimensions of the components.

It would have been obvious to one having ordinary skill in the art at time the invention was made to select the proper dimensions of components in order to achieve the desired spray pattern and invention size, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

14. Claim 20 rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent #JP10-299613 to Date. in view of U.S. Patent #4,350,301 to Erwin et al.

Date discloses the invention as described above but fails to disclose the needle valve being passively driven by high fuel pressure which provides the driving means.

Erwin however teaches it's known to drive a valve needle using fluid pressure [column 5, lines 33-61] as an equivalent driving means in order to provide enough force to lift the needle and allow fluid to flow through the injector device.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the valve needle and drive system of Date to be able to be driven by the pressure of fluid to be sprayed as disclosed by Erwin, because such modification is a known equivalent method of actuating a fuel injector's valve needle.

Response to Arguments

15. Applicant's arguments with respect to claims 1-23 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JUSTIN JONAITIS whose telephone number is (571)270-5150. The examiner can normally be reached on Monday - Thurs 6:30am - 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Len Tran can be reached on (571)272-1184. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 3752

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JUSTIN JONAITIS/
Examiner, Art Unit 3752
11-17-2010
/Len Tran/
Supervisory Patent Examiner, Art Unit 3752